

BTeV (Butler/Stone)

## Comments and Observations

The Committee received, in May, a "Preliminary Technical Design Report" (PTDR) and three presentations from the BTeV collaboration. The Committee commends the collaboration for the high quality of this material and the impressive amount of work on which it is based. As the collaboration describes it, the PTDR is a status report one year before submitting a final proposal.

The Committee notes that a dedicated B-physics experiment could well become a central part of the Laboratory's scientific program in the LHC era. The scientific potential of the Tevatron for B physics will be better understood next spring, after the workshop "B Physics at the Tevatron; Run II and Beyond." The Committee requests a status report on the workshop at the November 1999 meeting.

The charge to the Committee was to evaluate BTeV's progress and plans for R&D, to compare the physics capabilities of BTeV with other experiments, to make recommendations that will help BTeV to produce a proposal, and to advise the Laboratory on a process for reaching a decision on whether to approve BTeV. Here the Committee provides a summary of its observations and recommendations; more material is given in the Detailed Comments.

The BTeV collaboration has made substantial progress in several key R&D areas over the past year. BTeV has focussed on the most fundamental problems, which is essential, given their limited resources. Work on the pixel sensors, pixel readout, and triggering has been particularly effective. The collaboration has also identified a promising technology ( $\text{PbWO}_4$ ) for the electromagnetic calorimeter.

In the coming year, BTeV plans to address many other issues. The collaboration will perform a beam test of various pixel devices and study a wide variety of questions related to the trigger, forward tracker, RICH, electromagnetic calorimeter, and muon detector. The Committee is concerned, however, that the limited resources and personnel available to the collaboration could significantly slow these studies. The Detailed Comments note several issues that, we believe, warrant special attention.

The Committee also notes that BTeV would like to use the C0 interaction region as a test-beam facility. The Committee suggests that the Laboratory work with BTeV to understand the requirements for these tasks and their impact on Collider running.

The Committee has made a preliminary comparison of BTeV's physics reach to that of B experiments that will run before BTeV turns on, as well as to LHCb. Although, the comparison must be substantially refined, the Committee draws three preliminary conclusions:

- 1) BTeV has a substantial physics reach beyond that of  $e^+e^-$  experiments at the  $\Upsilon(4S)$ . This reach is due primarily to the much larger cross section for

- b production at a hadron collider and the substantial cross section for the  $B_s$  meson.
- 2) BTeV will likely have a physics reach substantially beyond that of CDF and D0, including their beyond-the-baseline upgrades. This reach is due mainly to BTeV's superior particle ID and EM calorimetry.
  - 3) The BTeV detector may be superior to the LHCb detector in three main areas: vertexing, triggering, and photon energy resolution. These capabilities may provide a physics reach comparable to or better than that of LHCb, but that has not yet been fully demonstrated.

### Recommendations

The Committee recommends that the BTeV collaboration work toward submitting a detailed proposal in May or October 2000. The proposal need not meet the standard of a fully engineered TDR. It should, however, include enough details on the design of the detector to demonstrate the feasibility, breadth, and precision of the experiment. In preparing its proposal, the BTeV collaboration should pay particular attention to the following key points:

1. The Committee would like to see a clear and convincing demonstration that BTeV has a physics reach superior to LHCb.
2. The Committee would like to see a clear and convincing case that all major detector systems are realizable and that the associated budgets are justified.
3. Simulations used in the detector-performance and physics-reach studies must be detailed and realistic, and they must include both physics and beam-related backgrounds, secondary interactions and decays, all significant environmental effects such as multiple interactions, and detector/electronics noise.
4. Critical representative physics analyses should be presented in detail. The Committee suggests a set of useful modes for such studies in the Detailed Comments.
5. Simulations should also be used to analyze how much the physics reach of the experiment is degraded if various components of the detector do not meet design specification.
6. The discussion of costs should be clear, detailed, and as uniform as possible. For each detector subsystem, there will be a trade-off between cost and performance. The Committee would like to see clear and quantitative discussions of these trade-offs whenever substantial cost differences are involved.

The Committee recommends that the Laboratory provide enough engineering resources to assist in the most difficult aspects of the design.

The Committee advises the Laboratory to proceed quickly to a decision on Stage I approval—within several months of receiving the proposal